



State of Utah

Department of  
Environmental Quality

Dianne R. Nielson, Ph.D.  
Executive Director

DIVISION OF WATER QUALITY  
Walter L. Baker, P.E.  
Director

JON M. HUNTSMAN, JR.  
Governor

GARY HERBERT  
Lieutenant Governor

M170049

cc: Paul  
Susan  
Tom

March 22, 2007

Ms. Christy Woodward, P.E.  
Tetra Tech EM, Inc.  
950 17<sup>th</sup> Street, 22<sup>nd</sup> Floor  
Denver, CO 80202

Dear Ms. Woodward:

Subject: Technical Justification for Ground Water Discharge Permit-By-Rule  
Tony M Mine Ground Water Evaporation Impoundment

The Division of Water Quality (DWQ) has reviewed the subject submittal dated February 21, 2007, which was received via email on March 8, 2007. The subject submittal was provided in response to a second DWQ request for information dated December 21, 2006 regarding a ground water discharge permit-by-rule-request for a total containment impoundment at the Tony M Mine. Although previous submittals dated September 6, 2006 and November 20, 2006 included information about the geology and hydrogeology of the project, you did not provide a technical justification for a ground water discharge permit-by-rule request.

Under UAC R317-6-6.2.A.25 of the Administrative Rules for Ground Water Quality Protection, facilities may be granted permit-by-rule if the Executive Secretary determines after a review of the application that the facility will have a *de minimis* (negligible) actual or potential effect on ground water quality. UAC R317-6-6.2.B stipulates that no facility permitted by rule under R317-6-6.2.A may cause ground water to exceed ground water quality standards or the applicable class TDS limits in R317-6-3.1 to R317-6-3.7. If the background concentration for affected ground water exceeds the ground water quality standard, the facility may not cause an increase over background. Permit-by-rule does not apply to facilities undergoing corrective action under R317-6-6.15A.3.

A technical staff review was conducted for your permit-by-rule justification. Our comments regarding this review are provided below.

### Ground Water Flow Modeling

Your February 21, 2007 submittal included a report that provided ground water flow modeling to evaluate whether seepage from the impoundment would cause increased hydraulic head in the Salt Wash Member aquifer to cause poorer quality water to flow into deeper aquifers. The results of this ground water flow modeling suggest a *de minimis* impact on the underlying Salt Wash Member aquifer and more importantly, the deeper high quality aquifers of the Entrada and Navajo Sandstones. However, the overall limitations on both the model and the input parameters make this justification less certain.

## Site Geology

The geology, hydrogeology, and stratigraphy of the proposed impoundment site provide a more certain and persuasive argument for a *de minimis* discharge than the submitted ground water flow modeling. Based on the geologic map by Jackson and Noller (1991), roughly half of the impoundment area is underlain by the Brushy Basin Member of the Morrison Formation, and the other half is underlain by the Salt Wash Member. The Brushy Basin Member is composed primarily of bentonitic mudstone, which acts as a particularly effective natural barrier to downward migration of impounded waters. Although the Salt Wash Member consists primarily of sandstone, this Member is interbedded with mudstone and siltstone units of varying thicknesses. Boring logs of eight borings in the former impoundment area indicate thicknesses of clay and mudstone ranging from two to 16 feet, with an average thickness of nine feet. The natural infiltration barrier provided by the mudstones of the Brushy Basin and Salt Wash Members will be augmented by the engineering design and construction of a clay liner for the proposed impoundment. The suitability of the clay liner material at the site was demonstrated by geotechnical testing. After a composite sample of existing clay liner material was compacted to 95 percent of the maximum dry density at optimum moisture content, a falling head permeability test of this sample yielded a coefficient of permeability of  $5.4 \times 10^{-9}$  cm/sec.

The uppermost ground water at the site is the perched aquifer of the Salt Wash Member. The ground water quality of the perched Salt Wash aquifer is Class III Limited Use Ground Water based on TDS concentrations in excess of 3,000 mg/l and/or elevated concentrations of gross alpha, uranium and radium in excess of the Utah ground water quality standards. The proposed evaporation impoundment will contain ground water pumped from the perched aquifer in the Salt Wash Member. Therefore, any small amount of seepage through the impoundment liner and underlying mudstones will have a negligible impact on the water quality of the perched Salt Wash aquifer immediately below, from which it was extracted.

Of more importance than the Class III perched Salt Wash Member aquifer are the deeper Entrada and Navajo Sandstone aquifers, which contain Class IA Pristine quality ground water. These high quality aquifers are naturally protected by the site geology and stratigraphy. In addition to being limited in saturated extent, the Salt Wash Member perched aquifer is separated from the Entrada Sandstone by the 180-foot thick Summerville Formation, which consists of alternating beds of marine sandstone, mudstone, siltstone and shale and is considered an aquitard or possibly an aquiclude. Given the unsaturated state and low permeability of the Summerville Formation, a large amount of additional head would be necessary for the possibility of downward migration of mine water. As stated above, only minor amounts of leakage from the pond will occur and in any event will be insufficient to overcome the 180 feet of the low-permeability Summerville Formation. Similar to the Entrada Sandstone being protected by the overlying Summerville Formation, the Navajo Sandstone is protected by the overlying Carmel Formation, which is a heterogeneous unit composed of interbedded sandstone, mudstone, limestone, dolomite, and gypsum. In addition to the overlying aquitard of the Carmel Formation, the confined Navajo aquifer is protected by the strong upward gradient indicated by hundreds of feet of hydraulic head measured in Plateau Resources Limited wells completed in the Navajo aquifer near the Frank M. Portal and the Shootaring Canyon Mill.

## Conclusions

Permit-by-rule may be granted for a facility if the applicant demonstrates that any potential discharge will have a *de minimis* actual or potential effect on ground water quality and will not cause ground water to exceed ground water quality standards or the applicable class TDS limits as defined in UAC R317-6-3 of the Ground Water Quality Protection Rules. Based on the site geology, hydrogeology and stratigraphy, the proposed evaporation impoundment meets these criteria as summarized below.

- Any seepage of Salt Wash Member ground water that may flow through the engineered clay liner and Brushy Basin Member will be a *de minimis* discharge since it will return to the perched Salt Wash Member aquifer where it originated.
- The results of ground water flow modeling suggests a *de minimis* impact on the underlying Salt Wash Member aquifer from the perspective of adding additional head to the perched Salt Wash Member aquifer.
- The beneficial uses of the pristine quality Entrada and Navajo Sandstone aquifers are naturally protected by thick low-permeability aquitards.
- The Entrada Sandstone aquifer is separated from the Salt Wash Member by the 180-foot thick Summerville Formation, which consists of alternating beds of marine sandstone, mudstone, siltstone and shale.
- The Navajo Sandstone aquifer is protected by the overlying Carmel Formation, which is a heterogeneous unit composed of interbedded sandstone, mudstone, limestone, dolomite, and gypsum.
- In addition to the overlying aquitard of the Carmel Formation, the confined Navajo aquifer is protected by the strong upward gradient indicated by hundreds of feet of hydraulic head measured in nearby wells.

#### **Construction Permit Required**

Ground water discharge permit-by-rule is hereby granted under the condition that a Construction Permit is obtained from DWQ prior to any construction. After discussing best available technology options with DWQ for an impoundment total containment system, IUC will need to submit engineering design plans and specifications to DWQ that have been prepared by a professional engineer licensed in the State of Utah. In addition, an independent third party construction quality assurance and quality control (CQA/QC) contractor will be required to certify the construction and submit a CQA/QC certification report for review and approval by DWQ.

If you have any questions about this letter, please contact Rob Herbert by email at [rherbert@utah.gov](mailto:rherbert@utah.gov) or by phone at (801) 538-6038.

Sincerely,

Utah Water Quality Board



Walter L. Baker, P.E.  
Executive Secretary

Cc: Paul Baker, DOGM